A Study on the Inhibition Behavior of Polyethylene Glycol (PEG) in Copper Electrodeposition using EQCM

Ki-Deok Song* and Kwang-Bum Kim**

Department of Metallurgical Engineering, Yonsei University,

134 Sinchon-dong Seodamun-gu, Seoul, Korea

ABSTRACT

Copper metallization of chips has been the subject of an intense investigation for more than a decade because of the advantages of Cu relative to Al for chip wiring such as lower resistance, higher allowed current density, and increased scalability. And Damascene Cu electroplating for on-chip metallization, developed in the early 1990s, has been central to chip interconnection technology. In this process, superfilling, the ability of filling trenches and vias with Cu without creating a void or seam, is closely related to behaviors of additives.

Additives serving as throwing power enhancer or inhibitor have traditionally included polymers such as starch, polyethylene glycol(PEG) and polypropylene glycol(PPG) that tend to suppress electrodeposition currents at a fixed potential or, alternatively, increase the potential required for a fixed current. Especially PEG is commonly used in commercial acid copper electrodeposition baths.

Previous theories regarding the mechanism of PEG during copper deposition emphasize a strongly adsorbed PEG film or various copper ion-chloride-polymer complexes but uncertainty in mechanism has produced much confusion.

In this study the inhibition behavior of acid copper solution containing polyethylene glycol(PEG) was studied by an electrochemical microgravimetric technique using EQCM. PEG was found to act differently as an inhibitor in copper electrodeposition, depending on its concentration. At low contents of PEG, [Cu^{+}+PEG] complex formation was responsible for the inhibition process. At moderate to high concentrations, the PEG monolayer formation acted as a inhibition mechanism of copper deposition. Roles of PEG was also investigated in anodic dissolution Cu. In depth discussion about the roles of PEG in copper deposition will be made at the conference.

* e-mail : kidsong@yonsei.ac.kr

** e-mail : kbkim@yonsei.ac.kr